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EXAMINER	
BRINEY III, WALTER F	

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 10/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/608,785	ENZNER, GERALD	
	Examiner	Art Unit	
	Walter F Briney III	2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14 and 17-22* is/are rejected.

7)☒ Claim(s) *15 and 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *02 September 2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. **Claims 1-10 and 17-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Romesburg et al. (US Patent 6,160,886).**

Claim 1 is limited to *an echo cancellation system*. Romesburg discloses a method and apparatus for improved echo suppression in communication systems (see Abstract). Figure 5 depicts a block-diagram overview of the invention. Clearly, the device includes all the features of a standard full-duplex speakerphone, including *a microphone* (110), which will inherently pickup emitted loudspeaker waves (i.e. *responsive to an echo signal from a loudspeaker that provides an acoustic output* signal) that were caused by a far-end speaker (i.e. *in response to a voice signal*). In order to supply full-duplex communication, Romesburg includes an acoustic-echo canceller (140) (i.e. *and a statistical adaptive-filter controller*), the details of which are depicted in figure 6. Upon inspection of figure 6, it is evident that the gain control device (640) is responsible for generating both an echo step-size gain (645, see column 14, lines 58-62) (i.e. *a first control signal to an echo canceller module*) and at least one echo suppression coefficient (144a or 144b, see column 13, lines 56-61) (i.e. *a second control signal to a post-filter*). The signals are generated in response to the inputs, seen

as the power components 681 and 683 corresponding to the *voice signal and to an echo reduced microphone signal*, respectively. The step-size and attenuator gain components inherently *optimize cancellation of the echo signal*. Therefore, Romesburg anticipates all limitations of the claim.

Claim 2 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. As indicated in the rejection of claim 1, Romesburg discloses an acoustic-echo canceller, which is detailed in figure 6, and includes an adaptive update loop that includes a multiplier (676) that is fed both an updated coefficient set as well as a step size (645), often symbolized with the Greek letter μ (i.e. *wherein the first control signal is a step-size signal which is used to determine a gradient change of an echo transfer function signal provided to an echo canceller of the echo canceller module*). The gradient is added to the existing filter coefficients at an adder (666), the gradient being comprised of an echo-reduced signal, the filter coefficients from block 620, and the step size (see column 14, lines 58-62) (i.e. *according to a predetermined criteria*). Therefore, Romesburg anticipates all limitations of the claim.

Claim 3 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. As indicated in the rejection of claim 1, Romesburg discloses an acoustic-echo canceller, which also includes an echo-suppression unit (130). The echo-suppression unit is analogous to the post-filter of the claim. Romesburg depicts in figures 5 and 6 that the gain control device (640) is responsible for generating the signals α and Δ, which control the attenuation slope shown in figures 2 and 3 (i.e. *wherein the second control signal is a further transfer function signal of the post-filter,*

said further transfer function signal weights an echo reduced microphone signal). Therefore, Romesburg anticipates all limitations of the claim.

Claim 4 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. Romesburg discloses an echo suppression or AC-center attenuator in figure 5. It receives the output of the acoustic echo canceller (i.e. *responsive to an echo reduced microphone signal*) and two control signals (α and Δ) that dictate the attenuation to be applied (i.e. *and to the second control signal, for providing an output system signal*). Therefore, Romesburg anticipates all limitations of the claim.

Claim 5 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. Further attention will now be directed toward the operation of the echo canceller disclosed by Romesburg. While Romesburg does not explicitly disclose many of the advanced features of the echo canceller, the operation is clear from figure 6. In particular, buffer 630 receives a far-end voice signal (i.e. *responsive to the voice signal*) and applies adaptively updated coefficients to said voice signal at multiplier 672. The adaptively updated coefficients are updated in a fashion described above. In summary, they are modified by a gradient signal (677), which is a function of the echo output (145) (i.e. *an echo reduced microphone signal*), and a step size gain (645) (i.e. *the first control signal*). The result of the multiplication is signal 663 (i.e. *an estimated echo signal*) which is applied to *adder* 660. Therefore, Romesburg anticipates all limitations of the claim.

Claim 6 is limited to *the echo cancellation system of claim 5*, as covered by Romesburg. With respect to the rejection of claim 5, Romesburg depicts an echo

canceller in figure 6. It produces *an estimated echo signal* (663) to *an adder* (660) in response to a far-end *voice signal* (125) and *a transfer function* (610). Therefore, Romesburg anticipates all limitations of the claim.

Claim 7 is limited to *the echo cancellation system of claim 5*, as covered by Romesburg. With respect to the rejection of claim 5, Romesburg depicts an echo canceller in figure 6. It produces a *gradient* update signal (677) that updates the *echo transfer function* (610) in response to *the voice signal* – by way of the acoustic coupling - and a step size gain signal (645) (i.e. *first control signal*). Therefore, Romesburg anticipates all limitations of the claim.

Claim 8 is limited to *the echo cancellation system of claim 5*, as covered by Romesburg. With respect to the rejection of claim 5, Romesburg depicts an echo canceller in figure 6 and an AC center attenuator (i.e. *post-filter*) in figure 5. The post-filter receives the output of the echo-canceller (i.e. *responsive to an echo reduced microphone signal*) and applies attenuation according to the control signals α and Δ (i.e. *and to the second control signal, for providing an output system signal*). Therefore, Romesburg anticipates all limitations of the claim.

Claim 9 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. Romesburg depicts the details of an acoustic-echo canceller in figure 6. It generates *an echo reduced microphone signal* by way of *an adder* (660) stimulated with *a microphone signal* (115) and *an echo replica* (663). Therefore, Romesburg anticipates all limitations of the claim.

Claim 10 is limited to *the echo cancellation system of claim 1*, as covered by Romesburg. By merely observing the devices and data presented in the disclosure of Romesburg it is clear that it handles all calculations in the time-domain (i.e. wh*erein the statistical adaptive-filter controller, the echo canceller module and the post-filter operate in a time domain, and said first and second control signals are provided in the time domain as well*). Therefore, Romesburg anticipates all limitations of the claim.

Claims 17-22 are methods whose steps are inherently performed by the various systems recited in claims 1, 2, 3, 6, and 8. Therefore, claims 17-22 are rejected for the same reasons.

2. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Sörqvist et al. (US Patent 6,658,107).

Claim 1 is limited to *an echo cancellation system*. Sörqvist discloses a method and apparatus for providing echo suppression using frequency domain nonlinear processing (see Abstract). Figure 1 illustrates the block diagram overview of the echo canceller and nonlinear processor while figure 4 illustrates the mechanics of the nonlinear processor. Clearly, the acoustic echo canceller of figure 1 includes all the normal elements; *a microphone* (110), *responsive to an echo signal* s(t) that is emitted by *a loudspeaker* (120), and an adaptive echo path model (130) (i.e. *a statistical adaptive-filter controller, responsive to the voice signal and to an echo reduced microphone signal*). In addition, Sörqvist discloses that the linear model (130) is updated in any number of conventional manners, such as LMS, which makes use of

gradient updates, which inherently requires the linear model to be updated by way of *a first control signal*. Furthermore, Sörqvist generates a nonlinear transfer function (figure 4, element H(f)) (i.e. *a second control signal*) that is supplied to the nonlinear processor (140). The model control and nonlinear control both inherently *optimize cancellation of the echo signal*. Therefore, Sörqvist anticipates all limitations of the claim.

3. **Claims 1, 11, 13, and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by Enzner et al. (European Trans. On Telecommunications, vol. 13, no. 2, pages 103-114, March-April 2002).**

Claim 1 is limited to *an echo cancellation system*. Enzner discloses a partitioned residual echo power estimation for frequency-domain acoustic echo cancellation and post filtering (see Abstract). The basic components comprising this invention are depicted in figure 2. As with any acoustic echo canceller placed in a speakerphone, the system includes *a microphone* that receives noise, speech, and echo. It also includes a controlling block that is responsible for updating both the adaptive acoustic filter and residual echo noise reduction filter, which in this case is not illustrated but is inherently present. Because the update of the echo canceller and the noise reducer require different data, they receive different control signals (i.e. *a first and second control signal*). Therefore, Enzner anticipates all limitations of the claim.

Claim 11 is limited to *the echo cancellation system of claim 1*, as covered by Enzner. The filters disclosed by Enzner are based in the frequency domain. See section 2.3, in particular the last paragraph (i.e. *wherein the statistical adaptive-filter*

controller, the echo canceller module, and the post-filter operate in a frequency domain). Hence, it follows that the first and second control signals used for updating the filters are also in the frequency domain (i.e. *and said first and second control signals are provided in the frequency domain as well*). Therefore, Enzner anticipates all limitations of the claim.

Claim 13 is limited to *the echo cancellation system of claim 12*, as covered by Enzner. Enzner discloses that the analysis functions operate in the DFT domain (i.e. *wherein the frequency domain is implemented as a Discrete Fourier Transform (DFT) domain*). See section 2.3, in particular the last paragraph. Therefore, Enzner anticipates all limitations of the claim.

Claim 14 is limited to *the echo cancellation system of claim 13*, as covered by Enzner. In one embodiment of coherence calculations, Enzner discloses generating PSD estimates for the error and far-end speech input. See equations 45-47, generating the PSD estimates inherently requires at least two means (i.e. *a first power spectral density means, responsive to the voice signal, for providing a first power spectral density signal of the voice signal; a second power spectral density means, responsive to an echo reduced microphone signal, providing for a second power spectral density signal of the echo reduced microphone signal*). The partial residual echo estimate Φ_{BB} generated in response to the PDS estimates for the error and far-end signals are used to generate the step-size of the echo canceller and the post filter's transfer function (i.e. *a statistical adaptive-filter estimator, responsive to the first and to the second power*

spectral density signals, for providing the first and second control signals). See equation 13 and section 2.2. Therefore, Enzner anticipates all limitations of the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sörqvist in view of Romesburg.

Claim 12 is limited to *the echo cancellation system of claim 1*, as covered by Sörqvist. The linear model illustrated in figure 1 is essentially a black box. The operational features are not known, therefore, Sörqvist anticipates all limitations of the claim with the exception *wherein the statistical adaptive-filter controller and the echo canceller module operates in a time domain.*

Because the details of the linear model disclosed by Sörqvist are not known, one of ordinary skill would be required to seek out a linear model implementation. Romesburg conveniently supplies all the necessary function blocks necessary to implement a linear acoustic-echo canceller (figures 5 and 6). It would have been obvious to one of ordinary skill in the art at the time of the invention to implement the linear model of Sörqvist with the time-based echo canceller of Romesburg as Sörqvist

does not disclose these details and one of ordinary skill in the art would inherently have to select an implementation.

In view of the above combination, it is clear that first control signal is provided in a time-domain. Furthermore, the second control signal, shown in figure 4 as H(f) is in the frequency-domain. Therefore, Sörqvist in view of Romesburg makes obvious all limitations of the claim.

Allowable Subject Matter

Claims 15 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 15 is limited to *the echo cancellation system of claim 14*, as covered by Enzner. As clearly indicated in the applicant's specification, the current application differs from the Enzner reference by eliminating the step of calculating the residual echo for the purpose of generating the step size of the adaptive echo canceller. See page 9, first paragraph and equation 3. Therefore, Enzner anticipates all limitations of the claim with the exception *wherein said step-size signal is determined according to:*

$\mu(k) = |G'|^2 \, \Phi_{xx}(k) / \Phi_{ee}(k)$,

wherein $|G'|^2$ *is a predetermined constant and* $\Phi_{xx}(k)$ *and* $\Phi_{ee}(k)$ *denote the first and second power spectral density signals, respectively, and k is a frame time index.*

Furthermore, none of the cited prior art anticipates nor suggests replacing the approximated residual echo with a predetermined constant. The argument pertaining to

removal of an element or step and its function also fails to make up for the prior art's deficiencies. In particular, removal of a step, i.e. calculating the residual echo G(k), while maintaining its effect is proof of non-obviousness. Therefore, claim 15 is allowable over the cited prior art.

Claim 16 is dependent on claim 15 and is allowable over the cited prior art for the same reasons.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter F Briney III whose telephone number is 703-305-0347. The examiner can normally be reached on M-F 8am - 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester W Isen can be reached on 703-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WFB
9/30/04

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PRIMARY EXAMINER